3.—The pouch of Planigale subtilissima and other dasyurid marsupials

by P. Woolley[1]

Manuscript received 22 May 1973; accepted 17 July 1973

Abstract

Planigale subtilissima is little known. In the two female specimens available for study the structure of the pouch was different from that of all other dasyurid marsupials for which information is available. The structure of the pouch is described and compared with that of other dasyurids. Information obtained at the time of capture of the animals suggests that *P. subtilissima* breeds in the summer months.

Introduction

Two female *Planigale subtilissima* collected by the Combined Museum's Expedition to the Ord River, Western Australia in mid-January, 1972 were maintained at the Western Australian Museum, Perth by M. Archer until mid-September and then at La Trobe University, Melbourne by the author until their deaths in November, 1972. When captured one female (number 1) had young on the nipples but there were no young in the pouch of the other female (number 2). Both females were sent to Perth soon after capture; the young of female 1 were lost in transit.

Previously this species was known only from the type specimen,* a male, caught by Dr. Mjoberg's Swedish Scientific Expedition to Australia 1910-13 (Lonnberg 1913) and from six animals obtained by B. Rudeforth, in December 1949. Four of these animals, including both sexes, were maintained alive in the Zoology Department of the University of Western Australia, and general observations on their biology were made. Over a four month period in captivity "no young were observed, although the pouch of the female seemed to change in size as though in preparation for carrying young during that time" (Rudeforth 1950).

The pouch of Planigale subtilissima

On arrival in Perth the pouch of ♀1, which was now empty, was stained, the nipples elongated and the pouch hairs long and stained (M. Archer *in. litt.)*. The appearance of the pouch of ♀2 suggested to Archer that this female also was in breeding condition. The pouch hairs were slightly stained and slightly longer than the surrounding body hair and the nipples were well developed. By 10th February the pouch hairs had doubled in length. However, no young appeared and within a month the pouch hairs had become less prominent and remained so.

When the animals arrived in Melbourne the pouch of each animal was inconspicuous and the entrance to it partly covered by long hairs. Because of the difficulty in handling these very small animals (body weight 5.0 to 6.0 g) no detailed examination of the pouch was attempted while the animals were alive. The superficial appearance of the pouch throughout the period the animals were alive in Melbourne can be seen in Figure 1.

Examination of the pouch following the death of each animal revealed a structure different from that recorded for any other species of dasyurid marsupial. When the hairs covering the pouch region were clipped a fold of skin forming an anteriorly directed pouch with the opening at the rear could be seen, but no nipples could be found on the abdominal skin beneath the overlying fold. The pouch skin was dissected away from the body and two pockets were seen projecting forward from the anterior margin of the skin fold (Figure 2). After everting the pockets 5 nipples could be seen around the antero-lateral margins of each pocket (Figure 3). In each animal the hairs in the pockets and on the skin lining the entrance area were reddish brown in colour and there was an accumulation of dry red secretion around them.

The pouch of other dasyurid marsupials

The pouches of other species of dasyurid marsupials for which information is available appear to be of three general types:—

Type 1. The mammary area has no covering fold of skin. Marginal (usually lateral) ridges of skin develop during the breeding season.

Type 2. The mammary area is partially covered by a crescentic antero-lateral fold of skin. The fold is usually deepest anteriorly.

Type 3. The mammary area is covered by a circular fold of skin.

These three types of pouch are shown diagrammatically in Figure 4, together with a diagram of the pouch of *P. subtilissima* (Type 4) for comparison. The type of pouch found in various species of dasyurid marsupials is listed in Table 1.

The typical pouch condition may not always be apparent; it is seen only in the breeding season in all species with a Type 1 pouch, and

[1] Department of Zoology, La Trobe University, Melbourne, Australia.

* *Phascogale subtilissima*, transferred to *Planigale* by Troughton (1928).

Figure 1.—Ventral view of female 1 showing the entrance to the pouch which is partly covered by long hairs.

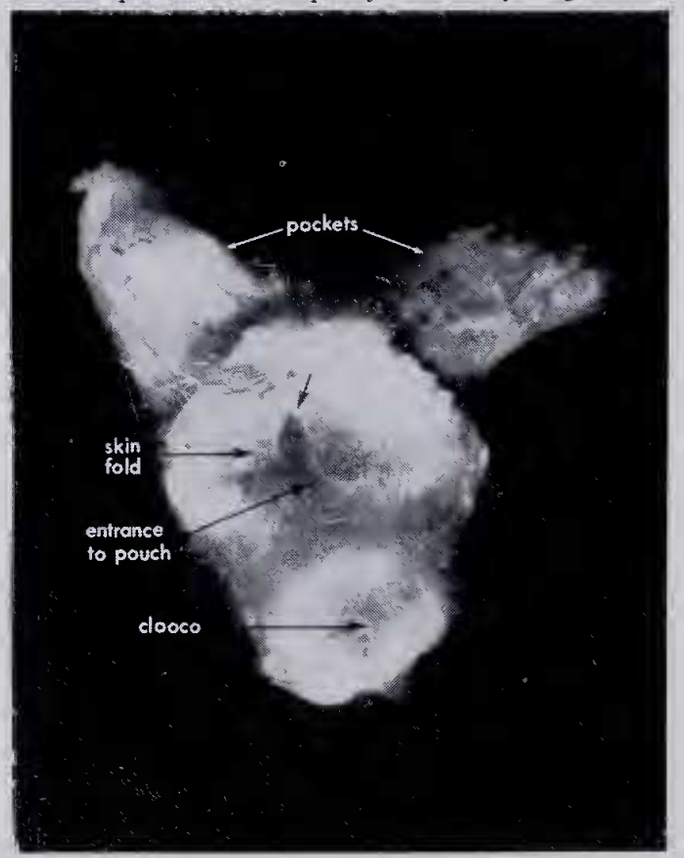

Figure 2.—The pouch and cloacal region of female 2 dissected from the abdomen. The V-shaped indentation (arrowed) in the skin fold covering the entrance to the pouch was probably an artefact caused by contraction of the loose skin. It was not present in female 1.

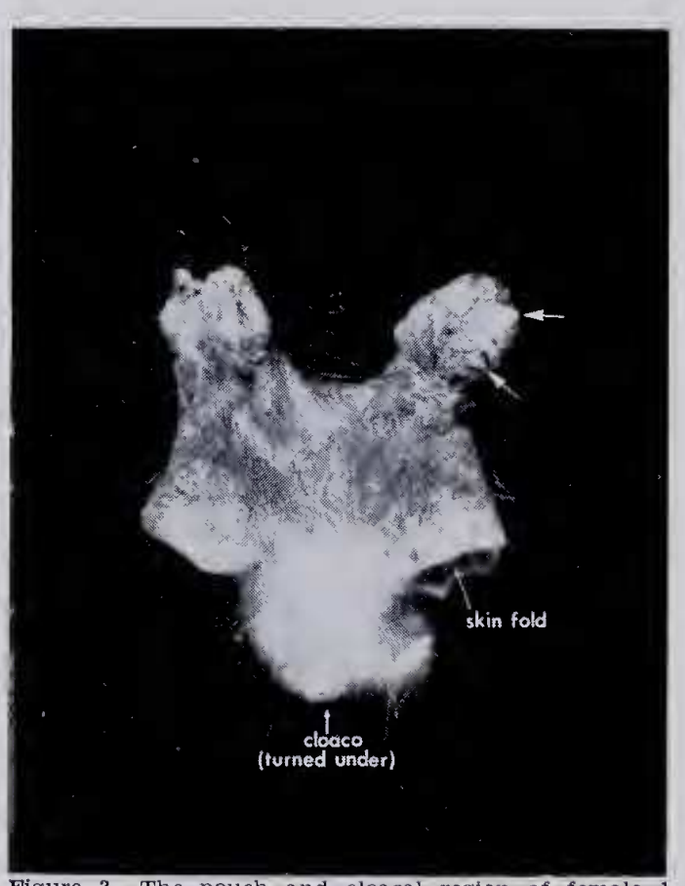

Figure 3.—The pouch and cloacal region of female 1 dissected from the abdomen. The skin fold has been turned forward and over and the two pockets everted to show the interior of the pouch. Arrows point to two of the five nipples in the left pocket.

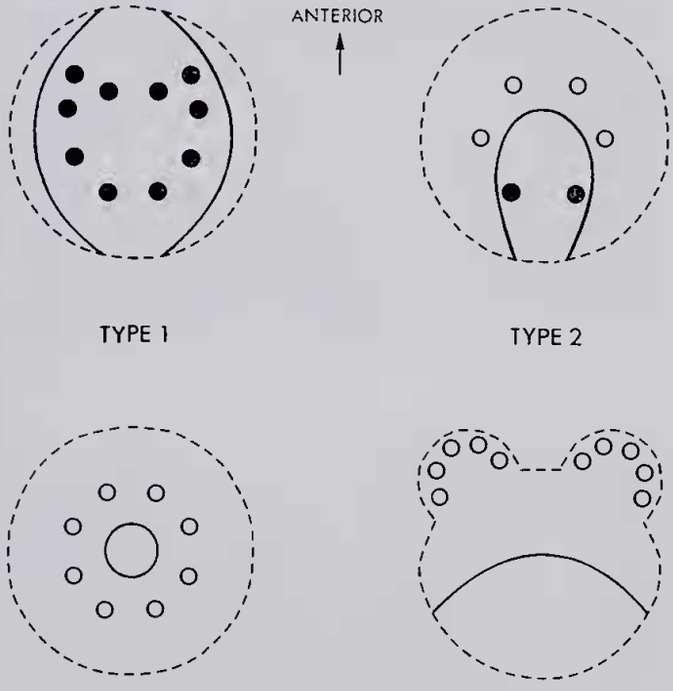

Figure 4.—Diagrammatic representation of the types of pouch found in dasyurid marsupials. The broken lines indicate the limits of the pouch area. The solid lines indicate, in Type 1, the marginal ridges of skin, and in Types 2, 3 and 4, the free edge of the fold of skin at the entrance to the pouch. Where the nipples are exposed they are shown as solid rather than open circles.

Table 1

The type of pouch in various species of dasyurid marsupials

Species	Pouch Type	Described by
Planigale subtilissima	4	Woolley, this paper.
Planigale ingrami	2	Troughton (1928), Heinsohn (1970).
Planigale tenuirostris	2	Troughton (1928).
Planigale gilesi	2	Aitken (1972).
Antechinus maculatus	2	Pocock (1926)—as *Phascogale minutissima*, Johnson (1964).
Antechinas staartii	1	Pocock (1926)—as *Phascogale unicolor*, Horner and Taylor (1959) and Marlow (1961) under misnomer *A. flavipes*, Woolley (1966a, b).
Antechinas flavipes flavipes	1	Pocock (1926)—as *Phascogale flavipes*, Fleay (1949), Woolley (1966b), Wakefield and Warneke (1967).
Antechinus flavipes leucogaster	1	Woolley (1966b).
Antechinas godmani	1	Wakefield and Warneke (1967).
Antechinus apicalis	1	Woolley (1971a).
Antechinus rosamondae	1	Ride (1964).
Antechinas macdonnellensis	1	Spencer (1896), Woolley (pers. obs.)
Antechinas swainsonii	1	Pocock (1926)—as *Phasogale swainsonii*, Fleay (1932), Wakefield and Warneke (1963), Woolley (pers. obs.).
Antechinus minimus	1	Wakefield and Warneke (1963).
Antechinomys spenceri	2	Pocock (1926), Woolley (pers. obs.).
Antechinomys laniger	2	Lidicker and Marlow (1970).
Sminthopsis crassicaudata	3	Pocock (1926), Fleay (1929), Smith and Godfrey (1970), Woolley (pers. obs./).
Sminthopsis larapinta	3	Godfrey (1969), Woolley (pers. obs.).
Dasycerus cristicauda	1	Spencer (1896), Pocock (1926), Jones (1949), Fleay (1961), Michener (1969), Woolley (1971b).
Dasyuroides byrnei	1	Spencer (1896), Jones (1923), Pocock (1926), Woolley (1971b).
Phascogale tapoatafa	1	Fleay (1934).
Satanellus hallucatus	1	Pocock (1926)—as *Dasyurus hallucatus*, Fleay (1962), Johnson (1964).
Dasyurus viverrinus	1	Pocock (1926), O'Donoghue (1911), Hill and O'Donoghue (1913), Fleay (1935a), Green (1967).
Dasyurus geoffroii	1	Pocock (1926).
Dasyurus maculatus	2	Pocock (1926), Fleay (1940).
Sarcophilus harrisii	2	Pocock (1926), Fleay (1935b), Green (1967), Guiler (1970).
Thylacinus cynocephalus	2	Pocock (1926).
Myrmecobius fasciatus	1	Jones (1923), Calaby (1960).
Neophascogale lorentzii	2	Pocock (1926)—as *Phascogale lorentzii*.
Phascocolosorex dorsalis	2	Pocock (1926)—as *Phascogale dorsalis*.
Myoictis melas	1	Pocock (1926)—as *Phascogale thorbeckiana*.

it may not be present in immature females of species with another type of pouch e.g. *Antechinomys spenceri* (Type 2 pouch). The skin fold in this species does not develop until the approach of the first breeding season (Woolley, pers. obs.) and this may account for statements that a pouch is absent in *A. spenceri* (see Lidicker and Marlow 1970 p. 219).

The appearance of the pouch is known to change during oestrus, pregnancy and lactation. The changes that occur during oestrus and pregnancy have been described in detail for *Antechinus stuartii* (Type 1 pouch) by Woolley (1966a, b), for *Dasyurus viverrinus* (Type 1 pouch) by O'Donoghue (1911) and for *Sminthopsis larapinta* (Type 3 pouch) by Godfrey (1969). Other species with a Type 1 pouch in which changes similar to those observed in *A. stuartii* during pregnancy, but not during oestrus, have been recorded include *Antechinus flavipes flavipes* and *Antechinus flavipes leucogaster* (Woolley 1966b), *Antechinus apicalis* (Woolley 1971a), *Dasycercus cristicauda* (Michener 1969; and Woolley 1971b) and *Dasyuroides byrnei* (Woolley 1971b). Smith and Godfrey (1970) noted changes in the pouch of pregnant *Sminthopsis crassicaudata* (Type 3 pouch) similar to those seen in *Sminthopsis larapinta*. Identical changes in the pouch are known to occur in females of many of these species kept isolated from males during the breeding season. Among species with a Type 2 pouch, changes in the pouch during the breeding season have been observed in *Planigale ingrami* (Fleay 1965), *Antechinomys spenceri* (Woolley, pers. obs.), *Dasyurus maculatus* (Fleay 1940) and *Sarcophilus harrisii* (Fleay 1935b).

The changes in the pouch that occur during lactation involve mainly enlargement of the mammary area, nipples and skin folds. Staining of the pouch skin and hairs may also occur. When the young are weaned the pouch slowly regresses to approximately the condition seen immediately prior to the commencement of the breeding season, except that the nipples remain slightly elongated and the pouch hairs sometimes lightly stained. The appearance of the nipples and pouch hairs provide a means of distinguishing between females that have reared young and those that have not.

Discussion

The pouch of *P. subtilissima* differs from that of other dasyurid marsupials in that the mammary area is more fully enclosed. The nipples are not located on the abdominal skin beneath the skin fold as in species with an enclosed mammary area (Type 2 or Type 3 pouch), but in two anteriorly directed pockets which are extensions of the area covered by the skin fold. Archer was able to see the nipples in both females when he received them but at the time of their deaths the nipples could not be seen until the pockets were everted. This suggests that the proportions of the pouch of each

animal were different at these times. Female 1 was known to have been suckling young and the nipples may have been visible as a result of general enlargement of the pouch to accommodate the young. The fact that he could see well developed nipples in female 2, together with the similarity in the appearance of the pouches of the two females, suggests that female 2 also had been suckling young which may have been lost at or shortly before capture. These observations on pouch development in the two females, together with that of Rudeforth (1950) mentioned above, suggest that *P. subtilissima* breeds in the summer months, unlike the majority of dasyurid marsupials (Woolley 1973).

A long period of lactation, ranging from 10 weeks in some species to 5 months or more in others (Woolley 1973) is characteristic of dasyurid marsupials. Like most other marsupials the young are born at a very early stage of development by comparison with placental mammals. The young suckle continuously for some weeks and then intermittently for the remainder of the period of lactation. When suckling becomes intermittent the young are not carried about by the mother at all times. During the period when suckling is continuous and the young are carried at all times the amount of cover afforded the young by the pouch is different for each type of pouch. In those species with a Type 1 pouch the young are almost completely exposed from the time of birth. The young of species with a Type 2 pouch may be covered by the skin fold only during the very early part of the period when suckling is continuous, as in *Antechinomys spenceri* (Woolley, pers. obs.) or for the entire period, as in *Sarcophilus harrisii* (Fleay 1935b). Fleay records that in this species suckling is continuous for 15 weeks, and 4 young can still be carried completely inside the pouch at 15 weeks. The young of *Sminthopsis larapinta,* which has a Type 3 pouch, are fully enclosed within the pouch for about 37 of the 40 days during which suckling is continuous (Godfrey 1969). Similarly, in *Sminthopsis crassicaudata,* which also has a Type 3 pouch, the young are fully enclosed while suckling is continuous (Ewer 1968). While no information is available on the development of the young or the duration of lactation in *P. subtilissima* it seems likely that the more fully enclosed mammary area would provide complete cover for the young for some time during lactation. The different types of pouch found in dasyurid marsupials must provide different environments for the young, at least during the early part of lactation, but what effect this may have on the development of physiological processes in the young is not known.

No obvious correlation can be seen between the type of pouch found in different species and the habitat of the animals, body size, the number of young per litter and the duration of the period of continuous suckling or the total period of lactation.

Acknowledgements.—The author wishes to thank Dr. D. Kitchener, of the Western Australian Museum, and the Department of Fisheries and Fauna, Western Australia, for the opportunity to study these animals, and Mr. M. Archer, of the Queensland Museum, for permission to refer to his unpublished observations.

References

Aitken, P. F. (1972).—*Planigale gilesi* (Marsupialia, Dasyuridae); a new species from the interior of south-eastern Australia. *Rec. S. Aust. Mus.* 16: 1-14.

Calaby, J. H. (1960).—Observations on the banded anteater *Myrmecobius f. fasciatus* Waterhouse (Marsupialia), with particular reference to its food habits. *Proc. zool. Soc. Lond.* 135: 183-207.

Ewer, R. F. (1968).—A preliminary survey of the behaviour in captivity of the dasyurid marsupial, *Sminthopsis crassicaudata* (Gould). *Z. Tierpsychol.* 25: 319-365.

Fleay, D. (1929).—The fat-tailed pouched mouse. *Vict. Nat.* 45: 278-280.

Fleay, D. (1932).—Swainson's phascogale (the "bush mouse"). *Vict. Nat.* 49: 132-134.

Fleay, D. (1934).—The brush-tailed phascogale. First record of breeding habits. *Vict. Nat.* 51: 89-100.

Fleay, D. (1935a).—Breeding of *Dasyurus viverrinus* and general observations on the species. *J. Mammal.* 16: 10-16.

Fleay, D. (1935b).—Notes on the breeding of Tasmanian devils. *Vict. Nat.* 52: 100-105.

Fleay, D. (1940).—Breeding of the tiger-cat. *Vict. Nat.* 56: 159-163.

Fleay, D. (1949).—The yellow-footed marsupial mouse. *Vict. Nat.* 65: 273-277. .....

Fleay, D. (1961).—Breeding the Mulgara. *Vict. Nat.* 78: 160-167.

Fleay, D. (1962).—The northern Quoll, *Satanellus hallucatus. Vict. Nat.* 78: 288-293.

Fleay, D. (1965).—Australia's "needle-in-a-haystack" marsupial. Vicissitudes in the pursuit and study of Ingram's Planigale, the smallest pouch-bearer. *Vict. Nat.* 82: 162-167.

Godfrey, G. K. (1969).—Reproduction in a laboratory colony of the marsupial mouse *Sminthopsis larapinta* (Marsupialia: Dasyuridae). *Aust. J. Zool.* 17: 637-654.

Green, R. H. (1967).—Notes on the Devil *(Sarcophilus harrisii)* and the Quoll *(Dasyurus viverrinus)* in north-eastern Tasmania. *Rec. Queen Vict. Mus.* No. 27: 1-13.

Guiler, E. R. (1970).—Observations on the Tasmanian Devil, *Sarcophilus harrisii* (Marsupialia: Dasyuridae). II. Reproduction, breeding and growth of pouch young. *Aust. J. Zool.* 18: 63-70.

Heinsohn, G. F. (1970).—World's smallest marsupial. The flat-headed marsupial mouse. *Animals* 13: 220-222.

Hill, J. P., and O'Donoghue, C. H. (1913).—The reproductive cycle in the marsupial *Dasyurus viverrinus. Quart. J. microsc. Sci* 59: 133-174.

Horner, B. E., and Taylor, J. M. (1959).—Results of the Archbold Expeditions. No. 80. Observations on the biology of the yellow-footed marsupial mouse, *Antechinus flavipes flavipes. Am. Mus. Novit.* No. 1972: 1-24.

Johnson, D. H. (1964).—Mammals of the Arnhem Land Expedition. In *"American-Australian Scientific Expedition to Arnhem Land. Records. 4. Zoology"*, 427-515. Melbourne University Press.

Jones, F. W. (1923).—*"The Mammals of South Australia."* Part 1. *The Monotremes and Carnivorous Marsupials.* Government Printer, Adelaide.

Jones, F. W. (1949).—The study of a generalised marsupial *(Dasycercus cristicauda* Krefft). *Trans. zool. Soc. Lond.* 26: 409-501.

Lidicker, W. Z., and Marlow, B. J. (1970).—A review of the dasyurid marsupial genus *Antechinomys* Krefft. *Mammalia* 34: 212-227.

Lonnberg, E. (1913).—Results of Dr. E. Mjoberg's Swedish Scientific Expeditions to Australia 1910-13. I. Mammals. *K. svenska Vetensk Akad. Handl.* 52 (1): 1-10.

Marlow, B. J. (1961).—Reproductive behaviour of the marsupial mouse, *Antechinus flavipes* (Waterhouse) (Marsupialia) and the development of the pouch young. *Aust. J. Zool.* 9: 203-218.

Michener, G. R. (1969).—Notes on the breeding and young of the crest-tailed marsupial mouse, *Dasycercus cristicauda. J. Mammal.* 50: 633-635.

O'Donoghue, C. H. (1911).—The growth-changes in the mammary apparatus of *Dasyurus* and the relation of the corpora lutea thereto. *Quart. J. microsc. Sci.* 57: 187-234.

Pocock, R. I. (1926).—The external characters of *Thylacinus, Sarcophilus* and some related marsupials. *Proc. Zool. Soc.* No. 68: 1037-1084.

Ride, W. D. L. (1964).—*Antechinus rosamondae,* a new species of dasyurid marsupial from the Pilbara district of Western Australia; with remarks on the classification of *Antechinus. W. Aust. Nat.* 9: 58-65.

Rudeforth, B. F. (1950).—Some notes on an interesting marsupial. *Scope* No. 5: 10-11.

Smith, M. J., and Godfrey, G. K. (1970).—Ovulation induced by gonadotrophins in the marsupial, *Sminthopsis crassicaudata* (Gould). *J. Reprod. Fert.* 22: 41-47.

Spencer, B. (1896).—Mammalia. In *"Report on the work of the Horn Scientific Expedition to Central Australia. Part 2. Zoology",* 1-52. London, Dulau and Co.

Troughton, E. Le G. (1928).—A new genus, species, and subspecies of marsupial mice (Family Dasyuridae). *Rec. Aust. Mus.* 16: 281-288.

Wakefield, N. A., and Warneke, R. M. (1963).—Some revision in *Antechinus* (Marsupialia)—1. *Vict. Nat.* 80: 194-219.

Wakefield, N.A., and Warneke, R. M. (1967).—Some revision in *Antechinus* (Marsupialia)—2. *Vict. Nat.* 84: 69-99.

Woolley, P. (1966a).—Reproduction in *Antechinus* spp. and other dasyurid marsupials. *Symp. zool. Soc. Lond.* no. 15: 281-294.

Woolley, P. (1966b).—Reproductive biology of *Antechinus stuartii* Macleay (Marsupialia: Dasyuridae). Ph. D. thesis, Australian National University, Canberra.

Woolley, P. (1971a).—Observations on the reproductive biology of the Dibbler, *Antechinus apicalis* (Marsupialia: Dasyuridae). *J. Proc. R. Soc. West. Aust.* 54: 99-102.

Woolley, P. (1971b).—Maintenance and breeding of laboratory colonies of *Dasyuroides byrnei* and *Dasycercus cristicauda. Int. Zoo Yb.* 11: 54, 351-354.

Woolley, P. (1973).—Breeding patterns, and the breeding and laboratory maintenance of dasyurid marsupials. *Exp. Animals* 22 Supplement, 161-172.